

## **Final Report**

Exploration of caves in the area surrounding Key Cave for the federally endangered  
*Speoplatyrhinus poulsoni*, the Alabama cavefish

Submitted to:

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and Fisheries,  
Montgomery, Alabama  
and

U.S. Fish and Wildlife Service,  
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## Introduction

The Alabama cavefish, *Speoplatyrhinus poulsoni*, is a stygobitic fish distinguished from other members of the family Amblopsidae by several unique morphological features and is restricted to a single cave in northwestern Alabama. *Speoplatyrhinus poulsoni* was described by Cooper & Kuehne in 1974 from Key Cave, Lauderdale County, located southwest of Florence and just north of the Tennessee River (now Pickwick Reservoir) (Figure 1). Populations of the widespread southern cavefish, *Typhlichthys subterraneus*, are found in numerous caves in the vicinity of Key Cave (Figure 1), but the two species have not been shown to be sympatric. In contrast to *T. subterraneus* (and other amblyopsids), *S. poulsoni* possesses a long head with a laterally constricted and dorsally flattened snout, lacks bifurcate fin rays, and has incised fin membranes (Cooper & Kuehne 1974).

The U.S. Fish and Wildlife Service (USFWS) listed *Speoplatyrhinus poulsoni* as Threatened in 1977. This listing was based on the likely restriction of *S. poulsoni* to Key Cave and its low abundance within the cave, estimated at less than one hundred individuals. This estimate was based on seven visits to Key Cave to collect the nine type specimens (Cooper & Kuehne 1974, Cooper 1975). Additional factors contributing to this listing included the possible disruption of the cave's ecosystem through disturbance of the annual maternal colony of gray bats (*Myotis grisescens*), groundwater pesticide pollution, and a proposed industrial park for the city of Florence (USFWS 1977).

Surveys of Key Cave by USFWS personnel (James Stewart, personal communication) and Richard M. Cobb (unpublished data) in the early and mid-1980's again suggested low population numbers for *Speoplatyrhinus poulsoni*, with a maximum

of 10 specimens viewed during one trip. Cobb (1985, 1986) also surveyed caves in the vicinity of Key Cave and failed to find any specimens of *S. poulsoni*, further supporting the restriction of the Alabama cavefish to Key Cave. A hydrological survey for a proposed solid-waste landfill for the city of Florence showed an existing sewage sludge disposal operation was likely within the recharge area of Key Cave (Aley 1986). Additionally, herbicide and pesticide applications to abundant cotton fields in the recharge area were shown to have direct access to Key Cave through the numerous surface pool seeps. These factors lead the USFWS to reclassified *S. poulsoni* as Endangered in 1988.

Despite this level of federal protection, urbanization and application of herbicides and pesticides to the recharge area of Key Cave continued into the 1990's. Additionally, only the first 60 m of the 3,340 m of passage containing only two of numerous pools within Key Cave had ever been repeatedly surveyed. Due to the continued threats of groundwater pollution, lack of information on the abundance and distribution of *Speoplatyrhinus poulsoni* throughout Key Cave, and a USFWS recovery objective (1990) for continued monitoring of this species, we resurveyed Key Cave for *S. poulsoni* between 1992 and 1997 (Kuhajda & Mayden 1997).

Results of this survey by Kuhajda and Mayden (1997) showed Alabama cavefish were present in up to five different pools and had numbers comparable to previous surveys performed in the last two decades. Three different size classes were observed, indicating recruitment is occurring. Alabama cavefish were extremely difficult to capture in Key Cave from the shoreline, therefore any mark and recapture program to accurately estimate the population size is unlikely. A single specimen of *Typhlichthys subterraneus*

was captured in Key Cave. This falsifies the previous assumption that these two species are allopatric.

Cobb (1985, 1986, 1989) considered 130 caves within the general area of Key Cave to search for additional populations of *Speoplatyrhinus poulsoni*. Twenty-eight caves had suitable conditions for possible populations of Alabama cavefish and were surveyed; no Alabama cavefish were found. Several of these caves had cavefish that Cobb could not positively identify. Additionally, Cobb excluded several caves with known populations of *Typhlichthys subterraneus* from his list of possible *S. poulsoni* habitat because the two species had historically been considered allopatric. In January 1995 during our survey of Key Cave, a 60 mm specimen of *T. subterraneus* was captured (Kuhajda & Mayden 1997). This discovery initiated our survey of caves in the area of Key Cave with known or presumed populations of *T. subterraneus*. We also resurveyed those caves where Cobb had reported unidentified cavefish or where muddy water prevented observations, another objective in the recovery plan for the Alabama cavefish (USFWS 1990).

## Methods

Nine caves were selected as potential habitat harboring additional populations of *Speoplatyrhinus poulsoni* and ranged from 1.2 to 45 km from Key Cave (A-I, Figure 1; Table 1). Cobb (1985) did not survey three caves to the south and west of Key Cave (Persimmon, Thomason, and McKinney) because previous biological surveys had shown the presence of *Typhlichthys subterraneus*. The discovery of both species of cavefish in Key Cave initiated the resurveying of these caves. Key Spring Cave was too turbid on all



three trips for Cobb (1985) to determine if any aquatic cave organisms were present. Because of its close proximity to Key Cave (1.2 km), it was also re-examined. The other caves we resurveyed (Bell, Elbow, Hound Dog Drop, Davis Bat, and Watkins Lake) had cavefish present that Cobb (1985, 1986, 1989) could not positively identify.

Cave surveys included observing and identifying cavefish from either the shoreline of shallow pools or snorkeling in deeper pools. We attempted to capture all observed cavefish with aquarium dipnets for photo-documentation, but in all cases positive identification was possible solely from in situ observations.

## Results

We were successful in gaining access to seven of the nine caves in 1999-2000. The owner of Persimmon and Thomason caves (Mrs. Thomason) (A & B, Figure 1) denied us access based on unauthorized collecting of cave organisms by previous visitors to these caves.

No cavefish were observed in two trips to Key Spring and Bell caves. Although Key Spring Cave (F, Figure 1) is extremely close to Key Cave, it has a different habitat; the entire cave is a huge slow-moving pool about 1 m deep and 155 m long. We experienced somewhat turbid waters within the cave, as did Cobb (1985), and found the source to be several large carp (*Cyprinus carpio*) stirring up the silt as they swam. We also observed a small sucker (Catostomidae) and numerous beaver cuttings. These epigean residents of Key Spring Cave indicate a direct connection to Pickwick Reservoir. Bell Cave (C, Figure 1) is located just across (south) the reservoir from Key Cave. Its

only pool was very small due to the extremely low water conditions; cave crayfish were present, but no cavefish were observed.

Thirteen trips to the remaining five caves resulted in the observation of 30 cavefish (Table 1). All cavefish were *Typhlichthys subterraneus*; no *Speoplatyrhinus poulsoni* were observed. Of these 30 sightings, only four specimens were captured; three were retained for future DNA analyses. Almost half of these observed specimens (12) were in Hound Dog Drop, Davis Bat, and Watkins Lake caves (G-I, Figure 1). These caves are relatively far from Key Cave (37-45 km) and they are located in a different geologic formation (Fort Payne Chert rather than Tuscumbia Limestone) (Cobb 1985). McKinney Pit and Elbow caves (D & E, Figure 1) are located just across (south) Pickwick Reservoir from Key Cave and have somewhat similar habitats to Key Cave. Seventeen specimens of *T. subterraneus* were observed in McKinney Pit, which has over a dozen pools. One specimen was observed in the single, large pool in Elbow Cave. Following is report for each cave that was surveyed. See Appendix A for specific localities of these caves.

Bell Cave – This cave is located along the Tennessee River bluff line across the river from Key Cave, only 2 km to its southwest (C, Figure 1). We reconnoitered the cave on 6 October 1999. The only water is in a single pool in a small passage at the end of this short (70 m) cave off of a 6 m deep pit that requires rappelling to enter (Figure 2). On 19 October 1999 we surveyed this cave for two hours; the water was clear and extremely low. We observed two cave crayfish near the small window at the rear of the pool. Snorkeling was not attempted because the pool was too small and shallow. No cavefish were observed.

McKinney Pit Cave – This cave across the Tennessee River from and only 2.4 km south-southwest of Key Cave (D, Figure 1). It is a very long cave (1405 m) and contains over a dozen pools; a 6 m rappel is required to gain access to the cave floor. Our first visit (7 July 1999) of 3.75 hours encompassed a thorough survey of the five pools on the east side of the cave and a survey of the first five pools on the northern side (Figure 3). The water was clear and low. The five eastern pools are small and relatively shallow (most to 0.5 m); four pigmented and two stygobitic crayfish were observed. The Boat Launch and subsequent northern pools are large and deep (to or > 6 m). The only way to proceed from one pool to another is to swim. Only one *Typhlichthys subterraneus* was observed, a 20 mm SL specimen in the third pool past the Boat Launch. No snorkeling occurred on this trip; all observations were from the shoreline.

On 22 September 1999 the water was very low and clear; we snorkeled all pools past and including the Boat Launch for 4.5 hours. A total of ten *Typhlichthys subterraneus* were observed in four different pools (Figure 5); two were captured and one of these vouchered in ethanol. Additionally, two cave crayfish and four cave isopods were observed; one of the cave isopods was vouchered in ethanol. We also observed five cave shrimp (*Palaemonias* sp.), preserving three in ethanol for vouchers and further identification. The closest known population of cave shrimp is the Alabama cave shrimp (*P. alabamae*) in the Huntsville area about 97 km to the east. Comparisons by Horton Hobbs III (personnel communication) indicate that this cave shrimp represents a new species that will be described in the near future.

During our 9 November 1999 trip the water was extremely low, milky, and covered with a film, making shoreline observations nearly impossible and snorkeling



difficult due to limited visibility. All five eastern pools were surveyed from the shoreline; only three cave crayfish were observed. We observed one *Typhlichthys subterraneus* from the shoreline as we approached the Boat Launch pool. We snorkeled the Boat Launch and two subsequent pools, no other organisms were observed, probably due to the poor viewing conditions. The trip was halted after the third pool.

Our last trip on 23 February 2000 encompassed surveying all pools past and including the Boat Launch pool for 4 hours. Water levels were the lowest yet, and we had great difficulty in extracting ourselves from several of the steep, slippery clay shorelines. Some suspended material was in the water column, but the water was relatively clear. A total of five *T. subterraneus* were observed in four different pools; one individual was vouchered in ethanol. We also observed two cave crayfish and several cave isopods. Five *Palaemonias* sp. were observed, and one of these was carrying about seven eggs. The four specimens without eggs were preserved as type material for this new species of cave shrimp.

Elbow Cave – The opening to this cave is 30 m East of Bell Cave (E, Figure 1). The cave gets its name from a 90° “elbow” in a narrow 0.5 m high section of passage. This relatively short cave (194 m) was reconnoitered by us on 23 September 1999, where we noted that a climbing system was required (> 3 m drop) to extract oneself from the large, deep (> 6 m) pool near the back of the cave (Figure 4). On 6 October 1999 two hours were spent in the cave surveying both the small pool at the end of the “muddy” passage from the shoreline and snorkeling in the deep pool at the end of the cave; the water was very clear in both pools. The small pool at the extreme end of the cave was not examined due to the lack of personnel necessary to scale the 2 m wall to gain access. One



40 mm SL *Typhlichthys subterraneus* and one cave crayfish were observed in the large pool, and a cave shrimp was netted and positively identified, then released.

On 9 November 1999 the cave was again surveyed for two hours; water conditions were low and very clear. One cave crayfish was observed from the shoreline in the small pool at the end of the “muddy” passage. Three observers snorkeled in the main pool, but only one cave crayfish was observed; the water became moderately turbid with so much activity in the water. The small pool at the end of the cave was surveyed, with the low water levels it was an extremely small, isolated pool with no observed aquatic life.

Our last trip on 23 February 2000 encompassed surveying both the small pool at the end of the “muddy” passage and the large pool for a total of two hours. Water was fairly clear, but the levels were the lowest yet, and the small pool was extremely low and had no observable aquatic life. In the large pool, no *Typhlichthys subterraneus* were observed, but one cave crayfish and one cave shrimp were collected and preserved in ethanol. Again, the cave shrimp specimen will be used as type material for this new species. The small pool at the far end of the cave appeared to lack water.

Key Spring Cave – This cave is closer to Key Cave than any other cave in our study, only 1.2 km to the ENE along the Tennessee River bluff line (F, Figure 1). Practically the entire cave is a huge pool of water (154 m) about 1 m deep (Figure 5). This system is a hybrid between standing pools and a stream; the flow is slow but noticeable. On 5 October 1999 we snorkeled the first 15 m of the cave in clear water and only observed one longear sunfish, *Lepomis megalotis*. At this point we climbed up a 4.5

m “chimney,” crawled through an upper passage, and noted that we needed climbing gear to descend into the water again. This survey took 1.25 hours.

We returned with the appropriate gear on 19 October 1999; no aquatic organisms were seen in the clear water for the first 15 m. After we descended from the upper passage near the Beaver Den (Figure 5), we noted that the water was slightly turbid. Snorkeling continued, and at least three large carp, *Cyprinus carpio*, we observed swimming and stirring-up the bottom. We also observed one sucker in the genus *Moxostoma*, as well as beaver cuttings throughout the cave. No stygobites were observed, and it appears that there is at least one direct connection between the cave and the adjacent Tennessee River based on the epigeal aquatic fauna present.

Hound Dog Drop Cave – This cave is located 37 km northeast of Key Cave (G, Figure 1), and requires a 12 m rappel to gain entrance. It differs from most other caves in this survey in having an underground stream rather than pools. The cave is several hundred meters long and unmapped. We surveyed about 100 m of clear stream over a two hours period on 22 September 1999 and observed two *Typhlichthys subterraneus*, one largescale stoneroller (*Camptostoma oligolepis*), and several pigmented crayfish.

Davis Bat Cave – This cave is along the bluff line of Second Creek, 40 km east-northeast of Key Cave (H, Figure 1). It is a complex maze of passages 345 m long, many of them with water (Figure 6). On 5 October 1999 we surveyed two small, shallow, clear pools from the shoreline near the front of the cave (Figure 6). Indiana and/or gray bats (about 70) were present in the “Bat Room,” so we restricted our visit to these two pools. One 15 mm SL *Typhlichthys subterraneus* was observed in the left pool along with several pigmented crayfish; only one pigmented crayfish was observed in the right pool.

Bats did not restrict our visit on 20 October 1999, so the whole cave was surveyed for 1.5 hours. All water was clear, but had a thick surface film that restricted viewing. All pools were too shallow for snorkeling. Only four pigmented crayfish were observed in the first left pool, but a 12 mm SL *Typhlichthys subterraneus* was captured in the main pool past the Bat Room (Figure 6), and at least four pigmented crayfish were observed. Water was present in the passage past the right pool, but the surface film was extremely thick; no aquatic organisms were observed.

Watkins Lake Cave - This cave is further from Key Cave than any other in our study, 45 km to the east (I, Figure 1). The cave is very short (35 m), with most of its length contained in two deep (8 m) pools that are probably interconnected (Figure 7, from Cobb 1985). On 20 October 1999 we surveyed both pools for two hours. The water was very clear. Two large *Typhlichthys subterraneus* (60-70 mm SL) and one cave crayfish were observed in the West Lake about 3 m deep. Observations in the East Lake revealed one southern cavefish and two cave crayfish.

On 10 November 1999 we surveyed both pools for 1.5 hours. Four and one *Typhlichthys subterraneus* and one and five cave crayfish were observed in the West and East Lake, respectively. Additionally, we had two cave divers explore both pools to see the extent of the underwater passages. The West Lake extended another 15 m to the northwest under the shelf on the north wall, where it became too narrow for the divers to proceed with their gear. The East Lake did not extend any appreciable distance past the surface pool.



## Conclusions

No *Speoplatyrhinus poulsoni* were observed during our survey of seven caves in 1999 - 2000. These data support the hypothesis that *Speoplatyrhinus poulsoni* is restricted to the Key Cave system. But given the small amount of aquifer available to us for observation in each cave, these results do not eliminate the possibility of discovering a range extension for the Alabama cavefish in the future. Although McKinney Pit Cave had been 'surveyed for biological content' (Cobb 1985, p. 8), we discovered a new species of cave shrimp during one trip. This is a prime example of how incomplete surveys of aquatic cave systems can be given the limitations of sampling within this environment.

All pools in Key Cave have little to no flow; if flow is present it is restricted to water movement out of a submerged window. Key Spring Cave is an unlikely candidate for future surveys given its somewhat lotic habitat, the number of epigean species present in the cave, and the lack of a bat population. Hound Dog Drop Cave is also a flowing system, but a population of gray bats is present. This cave, along with Davis Bat and Watkins Lake may deserve continued surveys, but their distance from Key Cave and their presence in the Fort Payne Chert make their candidacy suspect.

McKinney Pit and Elbow caves likely share the same aquifer; both caves have specimens of cave shrimp, and the rear of McKinney Pit is only 343 m from the back of Elbow Cave. Bell Cave is only 30 m west of Elbow Cave and it likely shares a common aquifer with both Elbow and McKinney Pit, but the pool in Bell Cave is small, especially under low water conditions, so it may not warrant additional surveying. Any unsurveyed



caves in the vicinity of Key Cave that have pools of water should be examined for populations of *Speoplatyrhinus poulsoni*.

### Conservation Status

Although the population of *Speoplatyrhinus poulsoni* in Key Cave appears to have remained stable over the last three decades (Kuhajda & Mayden 1997), disruptions within the recharge area could alter the status of this species. In January 1997 the USFWS purchased 1,060 acres within the recharge area and established the Key Cave National Wildlife Refuge, which is managed by Wheeler National Wildlife Refuge personnel. This encompasses most of the high recharge area. All cotton production was immediately replaced with soybeans and corn, and chemical use was restricted. Although 80 percent of the refuge is currently agricultural land, it will be converted to upland forest and/or native grasslands within the next decade.

These measures should go far towards protecting the aquatic habitat in Key Cave, although urbanization of the recharge area continues. An industrial park for the city of Florence has again been proposed. Concerns include a lowering of the water table due to impermeable surfaces and runoff into the recharge area of Key Cave from either the industrial site or from spills on the highways serving the park (USFWS, personal communication). The absence of *Speoplatyrhinus poulsoni* in our survey of potential habitats outside of Key Cave further indicate that it is restricted to this single cave system, and vigilant protection of this habitat is paramount to the continued existence of this endangered species.

### **Acknowledgments**

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**Table 1.** Number of southern cavefish, *Typhlichthys subterraneus*, observed and captured in nine caves in northwestern

Alabama and extreme southern Tennessee in 1999-2000.

Cave	County/State	Distance from Key Cave (km)	Date	n observed	n captured
Persimmon <sup>1</sup>	Colbert/AL	19	-	-	-
Thomason <sup>1</sup>	Colbert/AL	18	-	-	-
Bell	Colbert/AL	2	6 October 1999 <sup>2</sup>	-	-
			19 October 1999	0	-
McKinney Pit	Colbert/AL	2.4	7 July 1999	1	0
			22 September 1999	10	2
			9 November 1999	1	0
			23 February 2000	5	1
Elbow	Colbert/AL	2	23 September 1999 <sup>2</sup>	-	-
			6 October 1999	1	0
			9 November 1999	0	-
			23 February 2000	0	-

<sup>1</sup> Access denied by landowner.

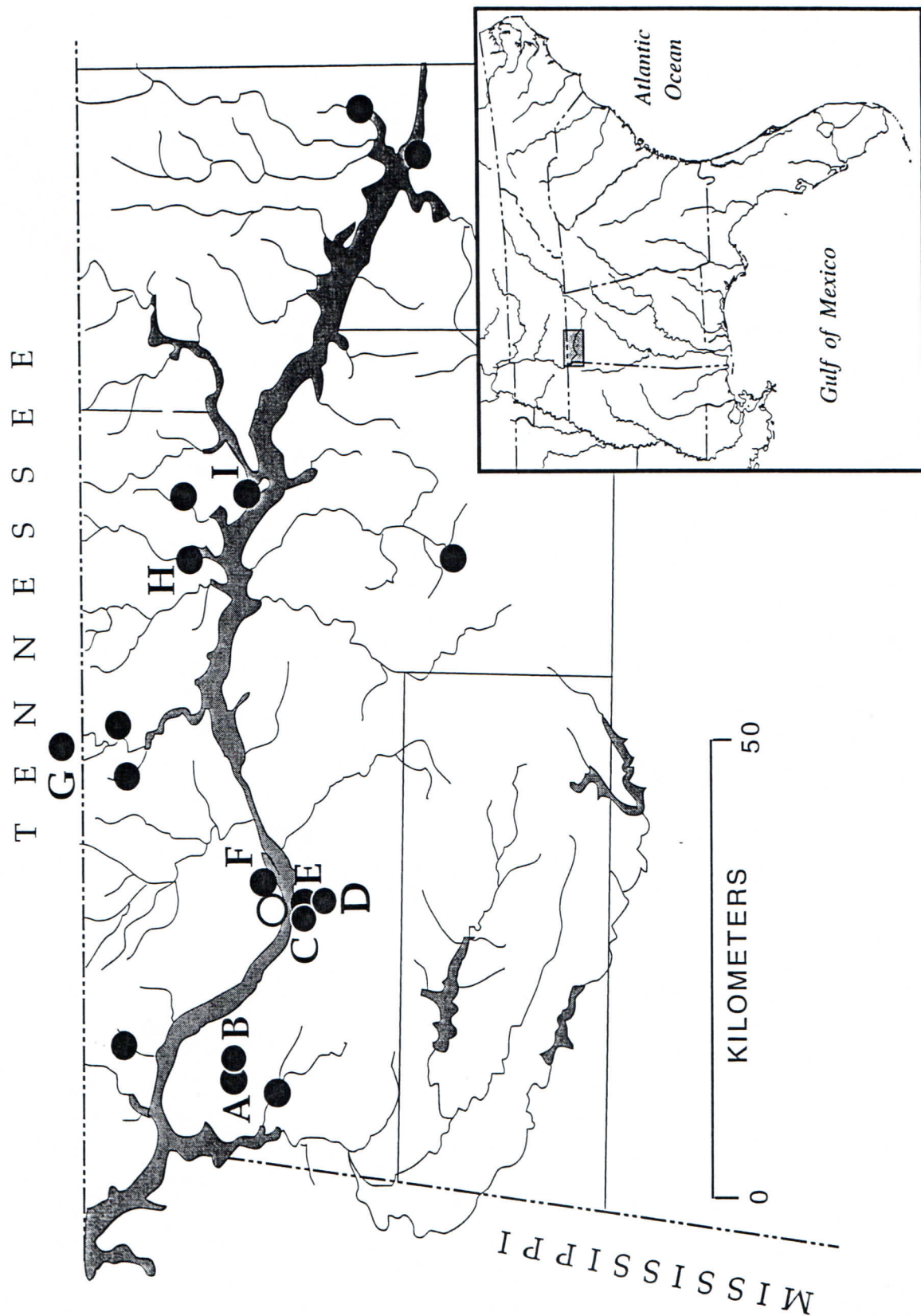
<sup>2</sup> Cave was reconnoitered for access, but not surveyed for cavefish.

**Table 1.** (continued).

Cave	County/State	Distance from Key Cave (km)	Date	n observed	n captured
Hound Dog Drop	Wayne/TN	37	22 September 1999	2	0
Key Spring	Lauderdale/AL	1.2	5 October 1999	0	-
			19 October 1999	0	-
Davis Bat	Lauderdale/AL	40	5 October 1999	1	0
			20 October 1999	1	1
Watkins Lake	Lauderdale/AL	45	20 October 1999	3	0
			10 November 1999	5	0

<sup>1</sup> Access denied by landowner.

<sup>2</sup> Cave was reconnoitered for access, but not surveyed for cavefish.



**Figure 1.** Open circle represents location of Key Cave. Closed circles represent distribution of *Typhlichthys subterraneus* in northwestern Alabama and extreme southern Tennessee. A = Persimmon Cave, B = Thomason Cave, C = Bell Cave, D = McKinney Pit Cave, E = Elbow Cave, F = Key Spring Cave, G = Hound Dog Drop Cave, H = Davis Bat Cave, I = Watkins Lake Cave.

Figure 2. Bell Cave.

# BELL CAVE

## AL1055

TAPE & COMPASS SURVEY  
BY THE HUNTSVILLE GROTTO, NSS  
30 SEPT 1972  
BILL TORODE  
PHILIP MALONE

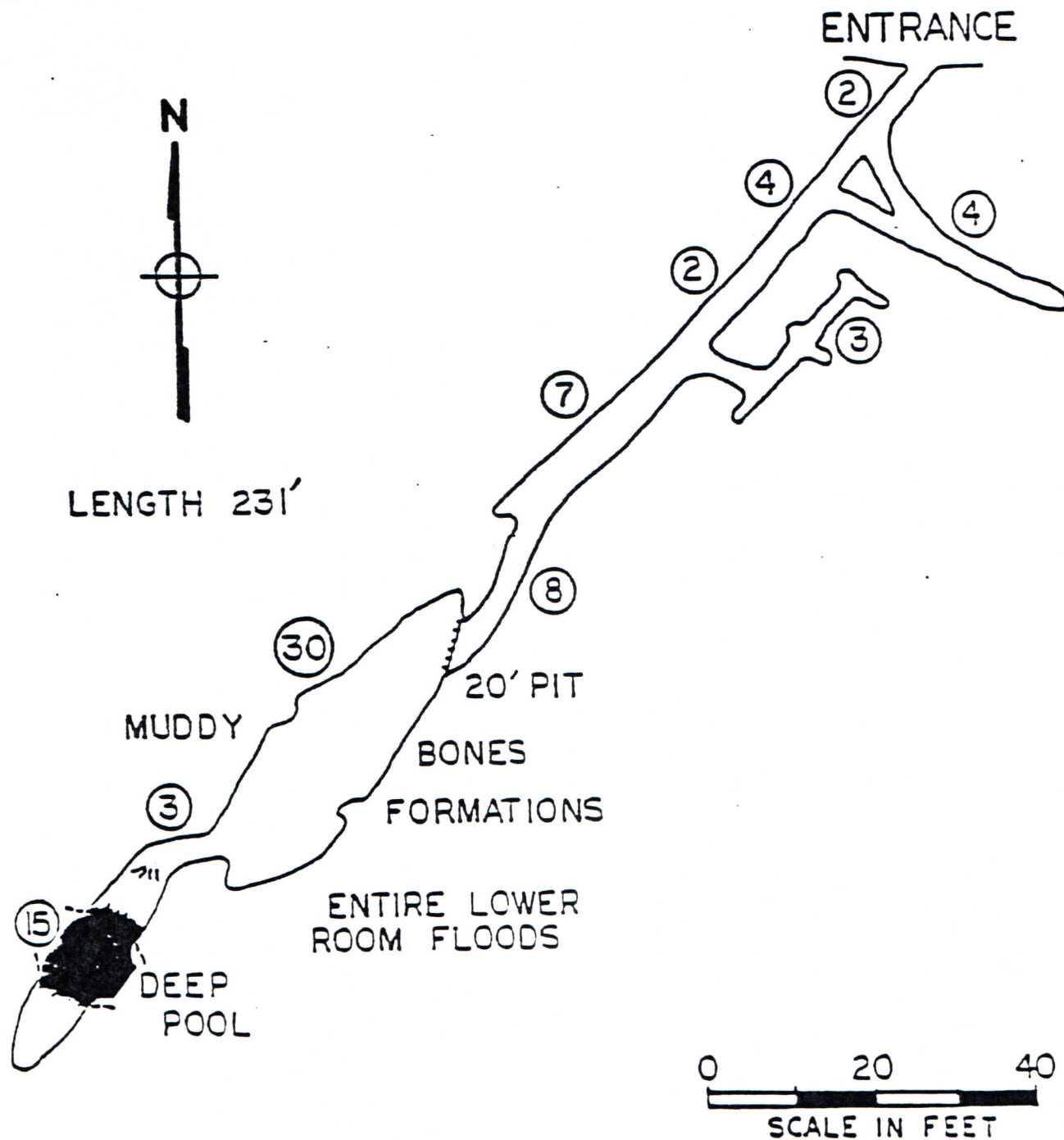




Figure 3. McKinney Pit Cave.

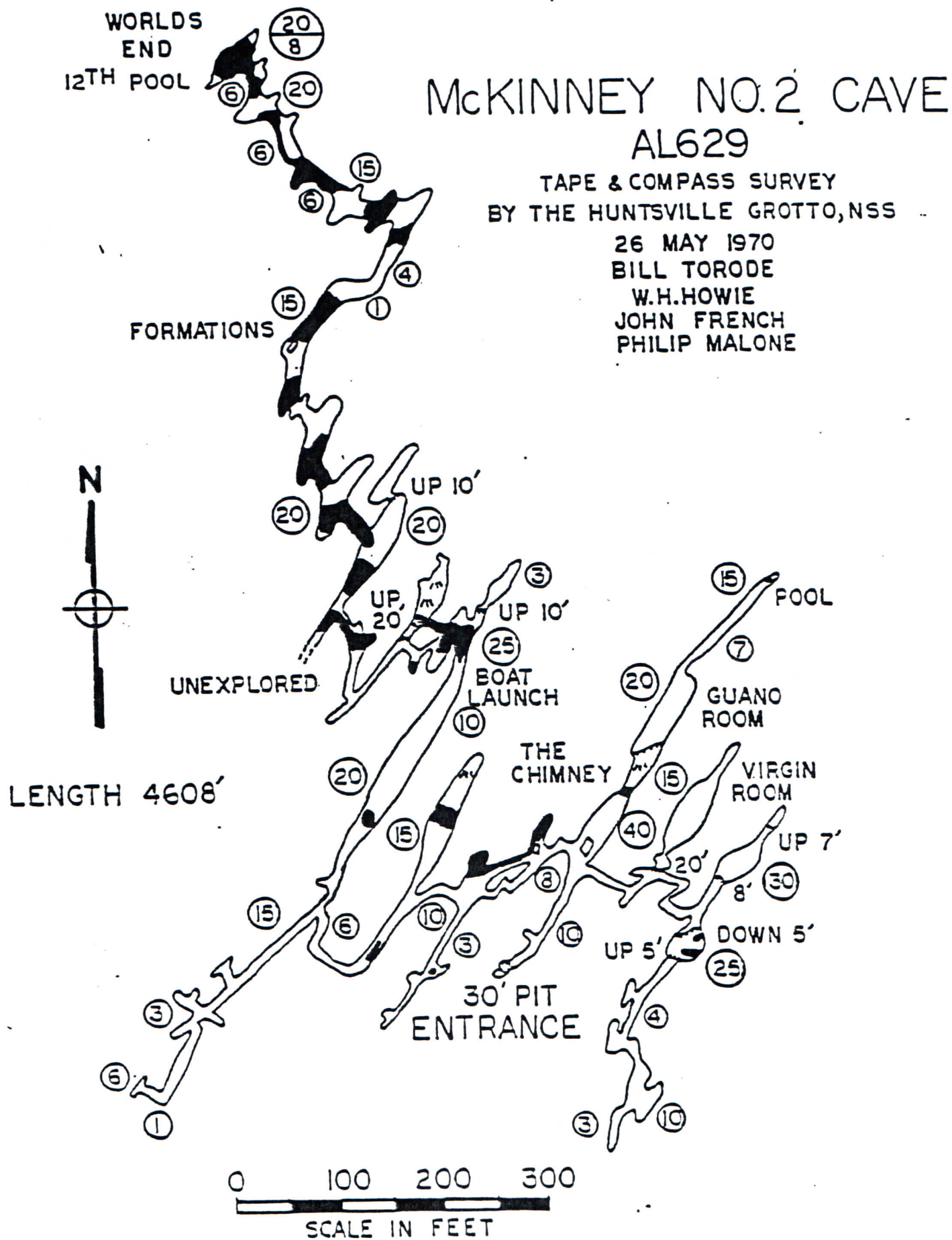


Figure 4. Elbow Cave.

# ELBOW CAVE AL1054

TAPE & COMPASS SURVEY  
BY THE DECATUR GROTTO, NSS  
AUG 1972

PHILIP MALONE  
NANCY MALONE

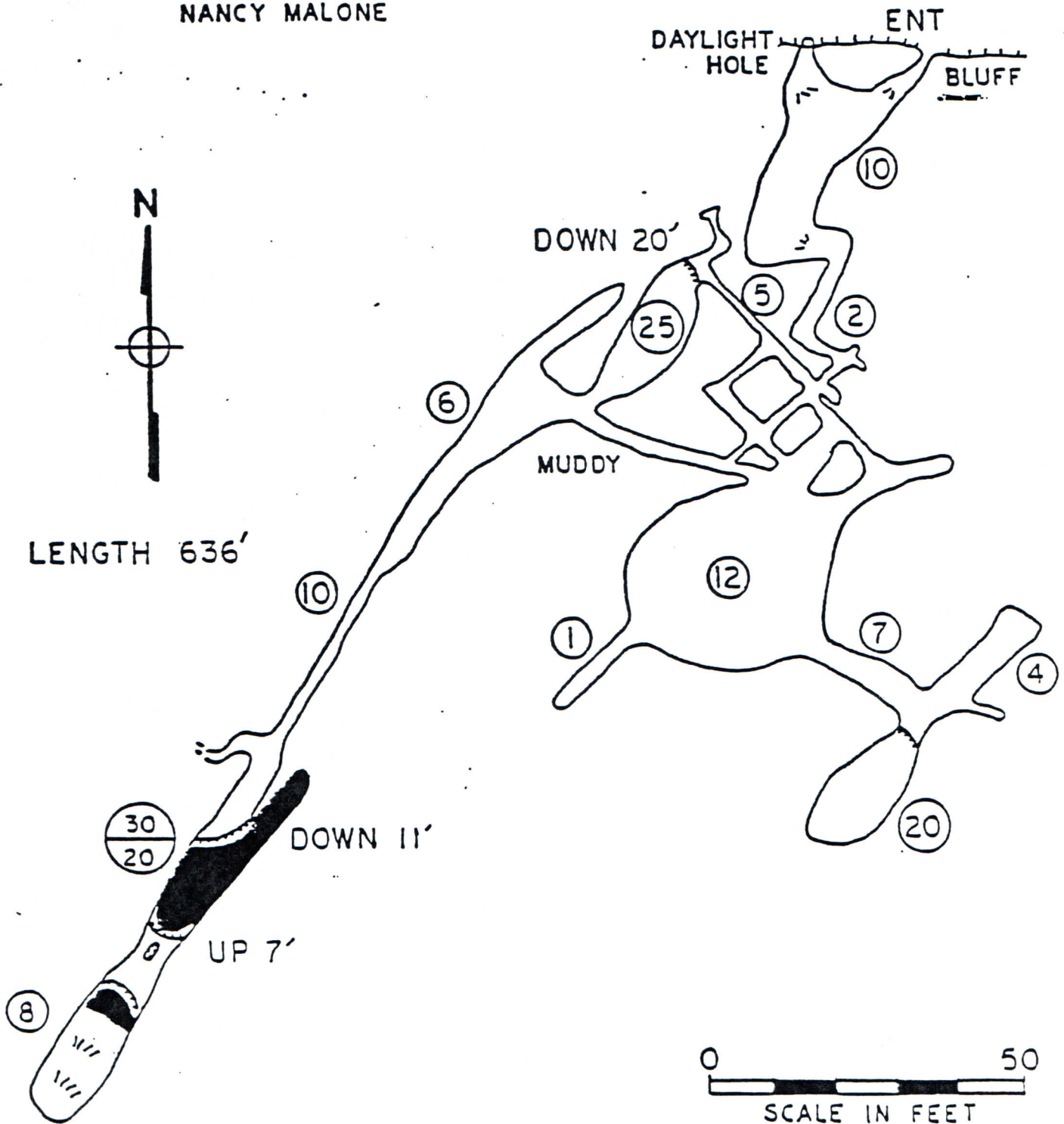


Figure 5. Key Spring Cave.

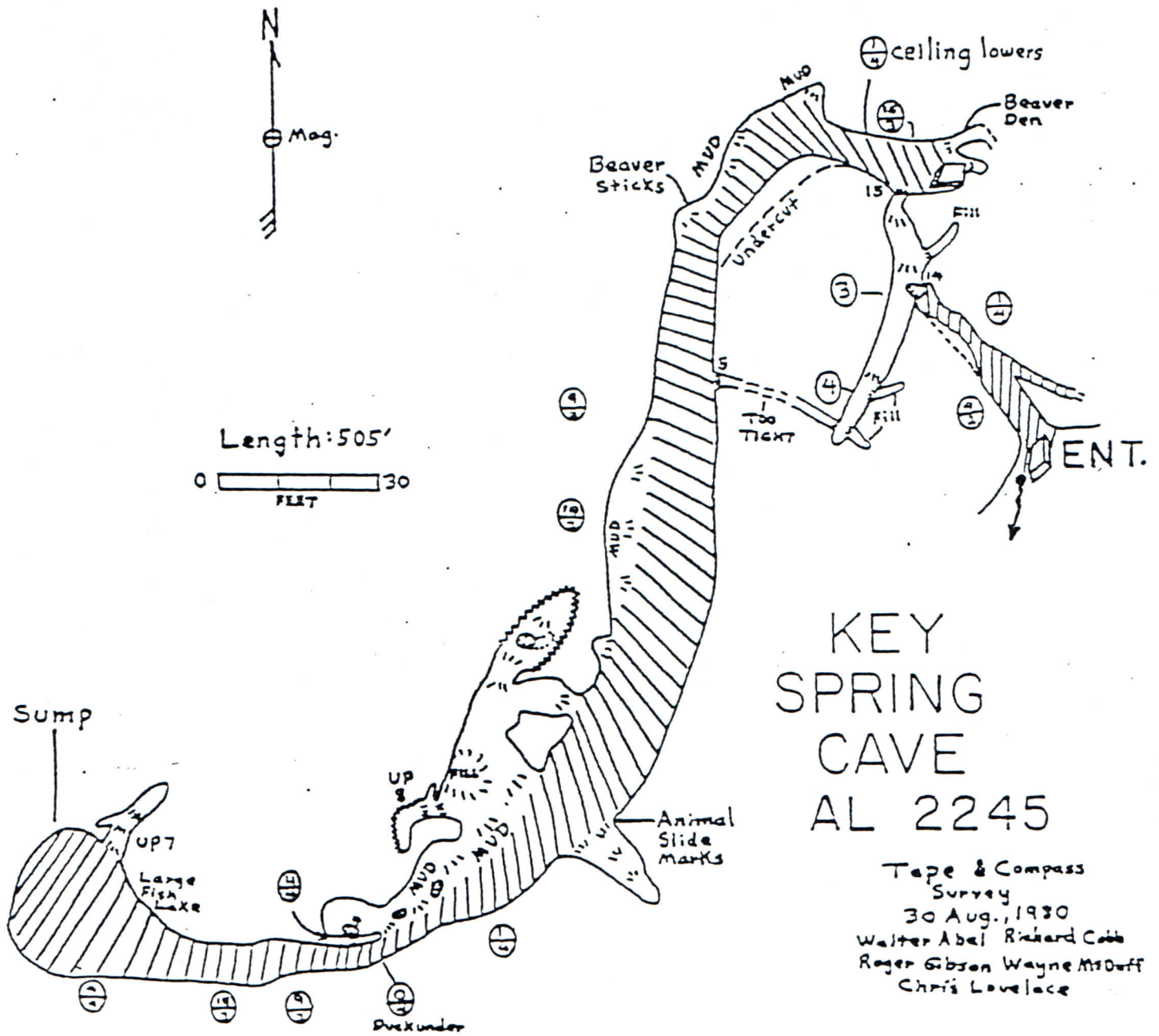
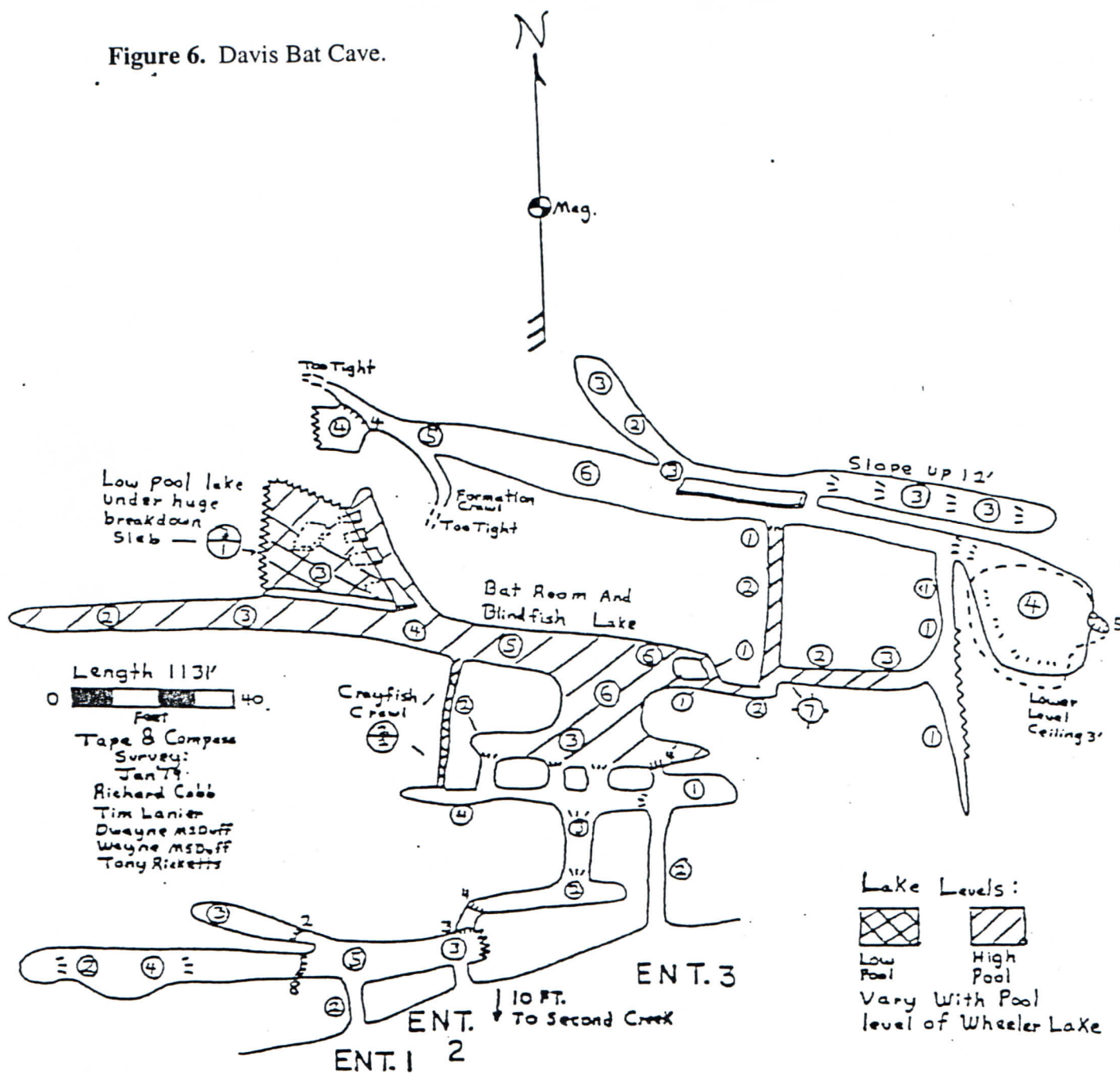


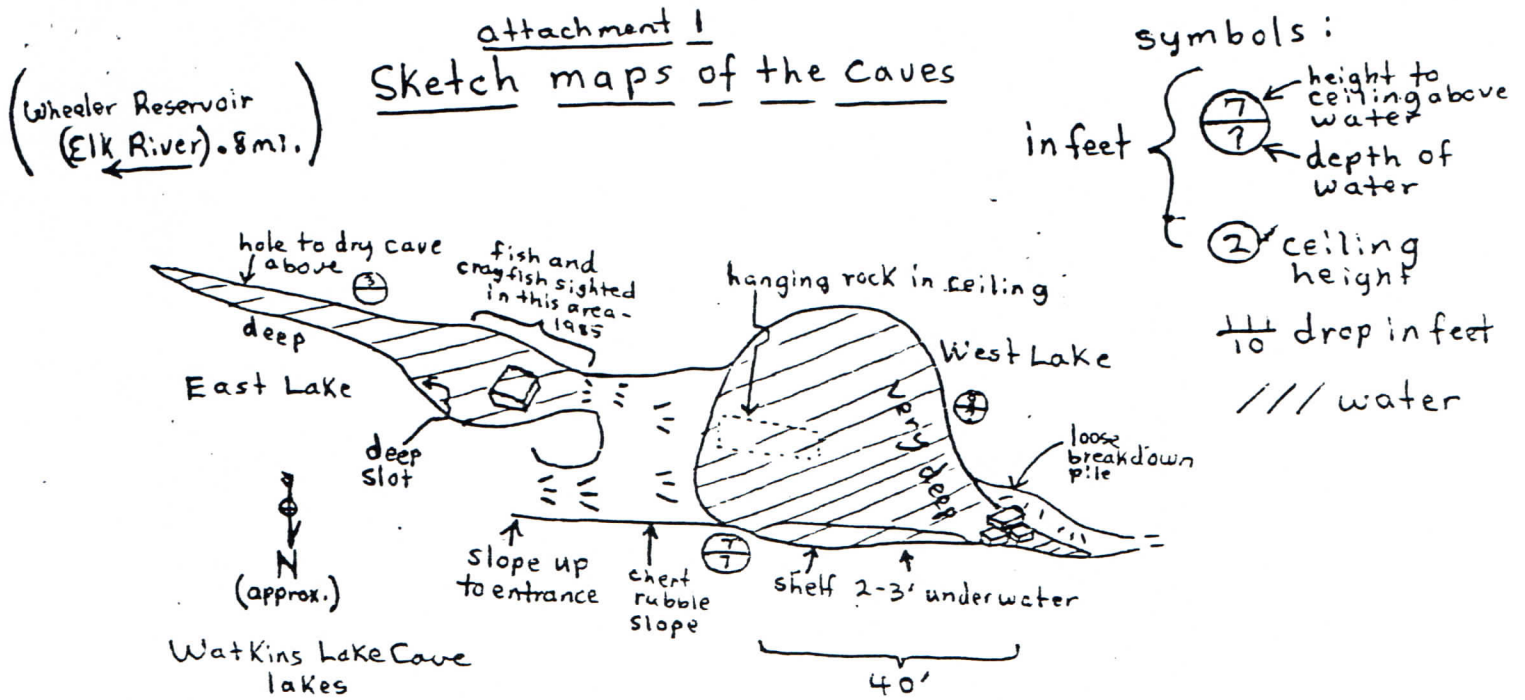
Figure 6. Davis Bat Cave.



DAVIS BAT  
CAVE  
AL. 1785



Figure 7. Watkins Lake Cave.



**Appendix A.** Locality for two caves proposed for surveying for cavefish and seven caves surveyed.

Persimmon Cave, Colbert Co., AL, Cherokee Quadrangle, 2.1 mi NW of Cherokee (T3S, R14W, S22 SE 1/4) (34°47'05", 87°59'15"W).

Thomason Cave, Colbert Co., AL, Cherokee Quadrangle, 2 mi NNW of Cherokee (T3S, R14W, S22 SE 1/4) (34°47'04", 87°58'49"W).

Bell Cave Colbert Co., AL, Pride Quadrangle, 1.6 mi ENE of Pride (T4S, R12W, S9 NE 1/4) (34°43'50"N, 87°47'56"W).

McKinney Pit Cave, Colbert Co., AL, Pride Quadrangle, 1.7 mi E of Pride (T4S, R12W, S10 W 1/2) (34°43'37"N, 87°47'40"W).

Elbow Cave Colbert Co., AL, Pride Quadrangle, 1.6 mi ENE of Pride (T4S, R12W, S9 NE 1/4) (34°43'50"N, 87°47'55"W).

Key Spring Cave Lauderdale Co., AL, Pride Quadrangle, 3.4 mi NE of Pride (T3S, R12W, S35) (34°44'55"N, 87°46'09"W).

Hound Dog Drop Cave, Wayne Co., TN, St. Joseph Quadrangle, 0.9 mi N of Iron City (35°02'53"N, 87°35'26"W).

Davis Bat Cave, Lauderdale Co., AL, Rogersville Quadrangle, 1 mi NW of Thorntontown (T2S, R8W, S27) (34°51'01"N, 87°21'47"W).

Watkins Lake Cave, Lauderdale Co., AL, Rogersville Quadrangle, 1 mi SE of Lambs Ferry (T3S, R7W, S20 SE 1/4) (34°46'12"N, 87°17'40"W).